



414 Pontius Ave North  
Seattle, WA 98109  
Ph: 206-622-6960  
Fx: 206-622-6870

07 March 2012

Wendy Kozma  
Lancaster Labs, Inc.  
2425 New Holland Pike, PO Box 12425  
Lancaster, PA 17605-2425  
RE: Arsenic Speciation

Enclosed are the analytical results for samples received by Frontier Global Sciences. All quality control measurements are within established control limits and there were no analytical difficulties encountered with the exception of those listed in the case narrative section of this report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in dark ink, appearing to read "C. Armstrong", with a stylized flourish at the end.

Curtis Armstrong  
Project Manager



414 Pontius Ave North  
Seattle, WA 98109  
Ph: 206-622-6960  
Fx: 206-622-6870

## ANALYTICAL REPORT FOR SAMPLES

**Laboratory:** Frontier Global Sciences, Inc.

**SDG:**

**Client:** Lancaster Labs, Inc.

**Project:** Arsenic Speciation

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
201.00-1,003.00,000. WELL 1-1	1202384-01	Water	27-Feb-12 14:30	28-Feb-12 08:27
201.00-1,003.00,000. WELL 1-2	1202384-02	Water	27-Feb-12 15:05	28-Feb-12 08:27
201.00-1,003.00,000. WELL 1-3	1202384-03	Water	27-Feb-12 15:10	28-Feb-12 08:27

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Curtis Armstrong, Project Manager

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## CASE NARRATIVE

Work Order Number: 1202384:

### SAMPLE RECEIPT

Samples were received at Frontier Global Sciences (FGS) on February 28th, 2012. The samples were received intact, on-ice with temperatures measured at 3.6 degrees Celsius.

### SAMPLE PREPARATION AND ANALYSIS

Samples were prepared and analyzed for total metals in accordance with EPA 1638.

Samples were prepared and analyzed for arsenic in accordance with EPA 1632.

### ANALYTICAL ISSUES

Liquid spikes were prepared for every preparation as a measure of accuracy. All liquid spikes and certified reference material were within the control limits.

As an additional measure of the accuracy of the methods utilized for analysis and to check for matrix interference, matrix spikes (MS) and matrix spike duplicates (MSD) were digested and analyzed. All of the matrix spike recoveries were within the control limits with the exception of any QC flagged and described in the notes and definitions section of the following report.

A reasonable measure of the precision of the analytical methods utilized for analysis is the relative percent difference (RPD) between matrix spike and matrix spike duplicate recoveries and between laboratory control sample and laboratory control sample duplicate recoveries. All of the relative percent differences were within the control limits with the exception of any QC flagged and described in the notes and definitions section of the following report.

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## CHAIN OF CUSTODY FORMS



Chain of Custody Record & Laboratory Analysis Request:  
Air, Water, Sediments, Plant and Animal Tissue,  
Hydrocarbon & Other Samples

11720 Northcreek Pkwy N, Suite 400  
Bothell, WA 98011  
Phone: 425-686-1996  
Fax: 425-686-3096  
info@FrontierGS.com  
http://www.FrontierGS.com

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1202384

Client: Cabot Oil & Gas, Corp. Address: 5 Penn Center West Suite 401 Pittsburgh, PA 15276 Project Name: PASUS-EPA-48743 Report To: Wendy Kozma Address: 2425 New Holland Pike PO Box 12425 Lancaster, PA 17605 Phone: 717-656-2300 Fax: 717-656-6766 E-mail: WKozma@lanasterlabs.com						Contact: Andy Mehalko Phone: 412-249-3852 Fax: E-mail: andy.mehalko@cabotog.com AFE#: 47745 Invoice To: Wendy Kozma Address: 2425 New Holland Pike PO Box 12425 Lancaster, PA 17605 Phone: 717-656-2300 Fax: 717-656-6766 E-mail: WKozma@lanasterlabs.com						Analyses Requested				FGS PM: Date: TAT (business days): 20 (std) 15 10 5 4 3 2 24 hrs. (For TAT < 10 days, contact PM. Surcharges apply for expedited TAT) Saturday delivery? <input type="checkbox"/> Y <input type="checkbox"/> N (If yes, please contact PM) EDD <input type="checkbox"/> Y <input type="checkbox"/> N QA <input type="checkbox"/> Standard <input type="checkbox"/> High			
No.	FAC ID	Sample ID	# of Bottles	Matrix	Date & Time	Sampled By	Field Filtered (Y/N)	Field Preserved: HNO <sub>3</sub> HCl BrCl Other (%)	Arsenic Speciation	Total Arsenic in Water					Comments				
1	201.00-1,003.00,000.	WELL 1-1	1	FW	3/27/12 1430		N		X	X					Analyses: Arsenic Speciation and Total Arsenic in Water (EPA 1632)				
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
For Laboratory Use Only						Matrix Codes:			Relinquished By:		Received By:		Received By:						
COC Seal: Intact		Cooler Temp: 3.6°C		Carrier: UPS		VTSR: 0827		# of Coolers: 1		Comments: 12 729 876 15 9388 9301 TID 3150		FW: Fresh Water WW: Waste Water SB: Sea and Brackish Water SS: Soil and Sediment TS: Plant and Animal Tissue HC: Hydrocarbons TR: Trap OT: Other		Name: Will Smith Organization: MGS & Associates Date & Time: 2/27/12 1655 Tracking number:		Name: Chris Dawley Organization: FGS Date & Time: 2/28/12 1143		Name: Organization: Date & Time:	

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Fax: 425-686-3096  
info@FrontierGS.com  
http://www.FrontierGS.com


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1202384

Client: Cabot Oil & Gas, Corp.		Contact: Andy Mehalko		Address: 5 Penn Center West Suite 401 Pittsburgh, PA 15276		Phone: 412-249-3852 E-mail: andy.mehalko@cabotog.com		Fax:		
Project Name: PASUS-EPA-48743		AFE#: 47745		Report To: Wendy Kozma		Invoice To: Wendy Kozma				
Address: 2425 New Holland Pike PO Box 12425 Lancaster, PA 17605		Address: 2425 New Holland Pike PO Box 12425 Lancaster, PA 17605		Phone: 717-656-2300 Fax: 717-656-6766		Phone: 717-656-2300 Fax: 717-656-6766		E-mail: WKozma@lancasterlabs.com		
E-mail: WKozma@lancasterlabs.com		E-mail: WKozma@lancasterlabs.com								
No.	FAC ID	Sample ID	# of Bottles	Matrix	Date & Time	Sampled By	Field Filtered (Y/N)	Field Preserved: HNO <sub>3</sub> HCl BrCl Other (%)	Analyses Requested	FGS PM:
1	201.00-1,003.00,000.	WELL 1-2	1	FW	2/27/12 1505		N	X	X	Date:
2										TAT (business days): 20 (std) 15 10 5 4 3 2 24 hrs.
3										(For TAT < 10 days, contact PM. Surcharges apply for expedited TAT)
4										Saturday delivery? <input type="checkbox"/> Y <input type="checkbox"/> N
5										(If yes, please contact PM)
6										EDD <input type="checkbox"/> Y <input type="checkbox"/> N
7										QA <input type="checkbox"/> Standard <input type="checkbox"/> High
8										Comments
9										Analyses: Arsenic Speciation and Total Arsenic in Water (EPA 1632)
10										
11										
12										
For Laboratory Use Only		Matrix Codes:		Relinquished By:		Received By:		Received By:		
COC Seal: <i>W/ACT</i>		Comments: 12 729 876 15 9365 8301		Name: <i>Will Smith</i>		Name: <i>Cori Dawley</i>		Name:		
Cooler Temp: <i>201.2 3.6 C</i>		TID 3150		Organization: <i>Mohr + Associates</i>		Organization: <i>Fus</i>		Organization:		
Carrier: <i>U85</i>				Date & Time: <i>2/27/12 1655</i>		Date & Time: <i>2/28/12 1143</i>		Date & Time:		
VTSR: <i>0827</i>				Tracking number:						
# of Coolers: <i>1</i>										

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No.	FAC ID	Sample ID	# of Bottles	Matrix	Date & Time	Sampled By	Field Filtered (Y/N)	Field Preserved: HNO <sub>3</sub> HCl BrCl Other (%)	Arsenic Speciation	Total Arsenic in Water					Comments		
1	201.00-1,003.00,000.	WELL 1-3	1	FW	2/27/12 1510		N		X	X					Analyses: Arsenic Speciation and Total Arsenic in Water (EPA 1632)		
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
For Laboratory Use Only						Matrix Codes:			Relinquished By:		Received By:		Received By:				
COC Seal: <i>Seal</i>		Comments: 12 729 876 15 9388 8301		FW: Fresh Water WW: Waste Water SB: Sea and Brackish Water SS: Soil and Sediment TS: Plant and Animal Tissue HC: Hydrocarbons TR: Trap OT: Other		Name: <i>Will Smith</i>			Name: <i>Caroline</i>		Name:						
Cooler Temp: 3.6°C							Organization: <i>Moxey &amp; Associates</i>			Organization: <i>FOS</i>		Organization:					
Carrier: UPS							Date & Time: 2/27/12 1655			Date & Time: 2/28/12 1143		Date & Time:					
VTSR: 0827		TID 3150					Tracking number:										
# of Coolers:																	

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Seattle, WA 98109  
Ph: 206-622-6960  
Fx: 206-622-6870

## Arsenate Analytical Results

Matrix: Water

Preparation: [CALC]

Sample Name	Result	MDL	Units	Batch	Prepared	Sequence	Analyzed	Method	Notes
201.00-1,003.00,000. WELL 1-1	22.0	4.50	µg/L	[CALC]	03/06/12		03/06/12	EPA 1632	
201.00-1,003.00,000. WELL 1-2	18.2	4.50	µg/L	[CALC]	03/06/12		03/06/12	EPA 1632	
201.00-1,003.00,000. WELL 1-3	175	4.50	µg/L	[CALC]	03/06/12		03/06/12	EPA 1632	

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## Arsenic Analytical Results

Matrix: Water

Preparation: Closed Vessel Nitric Oven Digestion

Sample Name	Result	MRL	Units	Batch	Prepared	Sequence	Analyzed	Method	Notes
201.00-1,003.00,000. WELL 1-1	105	0.7	µg/L	F203070	03/05/12	2C06014	03/06/12	EPA 1638	
201.00-1,003.00,000. WELL 1-2	99.1	0.7	µg/L	F203070	03/05/12	2C06014	03/06/12	EPA 1638	
201.00-1,003.00,000. WELL 1-3	171	0.7	µg/L	F203070	03/05/12	2C06014	03/06/12	EPA 1638	

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## Inorganic Arsenic Analytical Results

Matrix: Water

Preparation: No Preparation

Sample Name	Result	MRL	Units	Batch	Prepared	Sequence	Analyzed	Method	Notes
201.00-1,003.00,000. WELL 1-1	96.5	15.0	µg/L	F203078	03/06/12	2C06013	03/06/12	EPA 1632	
201.00-1,003.00,000. WELL 1-2	106	15.0	µg/L	F203078	03/06/12	2C06013	03/06/12	EPA 1632	
201.00-1,003.00,000. WELL 1-3	185	15.0	µg/L	F203078	03/06/12	2C06013	03/06/12	EPA 1632	

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414 Pontius Ave North  
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Fx: 206-622-6870

## Arsenite Analytical Results

Matrix: Water

Preparation: No Preparation

Sample Name	Result	MRL	Units	Batch	Prepared	Sequence	Analyzed	Method	Notes
201.00-1,003.00,000. WELL 1-1	74.4	3.00	µg/L	F203060	03/05/12	2C06006	03/05/12	EPA 1632	
201.00-1,003.00,000. WELL 1-2	87.8	6.00	µg/L	F203060	03/05/12	2C06006	03/05/12	EPA 1632	
201.00-1,003.00,000. WELL 1-3	10.9	6.00	µg/L	F203060	03/05/12	2C06006	03/05/12	EPA 1632	

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Fx: 206-622-6870

## MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY AND RPD

**SOURCE: 1202384-01RE1**

**Matrix:** Water

**Sequence:** 2C06006

**Batch:** F203060

**Lab Number:** F203060-MS/MSD1

**Preparation:** No Preparation

Analyte	Sample Concentration (µg/L)	Spike Added (µg/L)	MS Concentration (µg/L)	MS % Recovery	Recovery Limits	Method	Notes
Arsenite	74.41	75.000	157.9	111	30 - 170	EPA 1632	AS

Analyte	Spike Added (µg/L)	MSD Concentration (µg/L)	MSD % Recovery	% RPD	Recovery Limits	RPD Limit	Method	Notes
Arsenite	75.000	148.8	99.1	5.98	30 - 170	35	EPA 1632	AS

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Fx: 206-622-6870

## MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY AND RPD

**SOURCE: 1202384-01**

**Matrix:** Water

**Sequence:** 2C06014

**Batch:** F203070

**Lab Number:** F203070-MS/MSD1

**Preparation:** Closed Vessel Nitric Oven Digestion

Analyte	Sample Concentration (µg/L)	Spike Added (µg/L)	MS Concentration (µg/L)	MS % Recovery	Recovery Limits	Method	Notes
Arsenic	105.1	15.150	120.9	104	80 - 120	EPA 1638	

Analyte	Spike Added (µg/L)	MSD Concentration (µg/L)	MSD % Recovery	% RPD	Recovery Limits	RPD Limit	Method	Notes
Arsenic	15.150	120.0	98.5	0.681	80 - 120	20	EPA 1638	

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Fx: 206-622-6870

## MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY AND RPD

**SOURCE: 1202384-01**

**Matrix:** Water

**Sequence:** 2C06014

**Batch:** F203070

**Lab Number:** F203070-MS/MSD2

**Preparation:** Closed Vessel Nitric Oven Digestion

Analyte	Sample Concentration (µg/L)	Spike Added (µg/L)	MS Concentration (µg/L)	MS % Recovery	Recovery Limits	Method	Notes
Arsenic	105.1	101.00	203.7	97.6	80 - 120	EPA 1638	AS

Analyte	Spike Added (µg/L)	MSD Concentration (µg/L)	MSD % Recovery	% RPD	Recovery Limits	RPD Limit	Method	Notes
Arsenic	101.00	207.0	101	1.58	80 - 120	20	EPA 1638	AS

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## MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY AND RPD

**SOURCE: 1202384-01**

**Matrix:** Water

**Sequence:** 2C06013

**Batch:** F203078

**Lab Number:** F203078-MS/MSD1

**Preparation:** No Preparation

Analyte	Sample Concentration (µg/L)	Spike Added (µg/L)	MS Concentration (µg/L)	MS % Recovery	Recovery Limits	Method	Notes
Inorganic Arsenic	96.46	150.00	266.7	114	50 - 150	EPA 1632	AS

Analyte	Spike Added (µg/L)	MSD Concentration (µg/L)	MSD % Recovery	% RPD	Recovery Limits	RPD Limit	Method	Notes
Inorganic Arsenic	150.00	254.0	105	4.90	50 - 150	35	EPA 1632	AS

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## LABORATORY CONTROL SAMPLE/ LABORATORY CONTROL SAMPLE DUPLICATE

### RECOVERY AND RPD

**Matrix:** Water

**Sequence:** 2C06006

**Batch:** F203060

**Lab Number:** F203060-BS/BSD1

**Preparation:** No Preparation

**LCS Source:** Blank Spike

Analyte	Spike Added (µg/L)	LCS Concentration (µg/L)	LCS % Recovery	Recovery Limits	Method	Notes
Arsenite	0.030000	0.028	92.8	30 - 170	EPA 1632	

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## LABORATORY CONTROL SAMPLE/ LABORATORY CONTROL SAMPLE DUPLICATE

### RECOVERY AND RPD

**Matrix:** Water

**Sequence:** 2C06014

**Batch:** F203070

**Lab Number:** F203070-BS/BSD1

**Preparation:** Closed Vessel Nitric Oven Digestion

**LCS Source:** Blank Spike

Analyte	Spike Added (µg/L)	LCS Concentration (µg/L)	LCS % Recovery	Recovery Limits	Method	Notes
Arsenic	15.000	15.1	101	85 - 115	EPA 1638	

Analyte	Spike Added (µg/L)	LCSD Concentration (µg/L)	LCSD % Recovery	% RPD	Recovery Limits	RPD Limit	Method	Notes
Arsenic	15.000	15.6	104	3.15	85 - 115	20	EPA 1638	

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## LABORATORY CONTROL SAMPLE/ LABORATORY CONTROL SAMPLE DUPLICATE

### RECOVERY AND RPD

**Matrix:** Water

**Sequence:** 2C06013

**Batch:** F203078

**Lab Number:** F203078-BS/BSD1

**Preparation:** No Preparation

**LCS Source:** LCS

Analyte	Spike Added (µg/L)	LCS Concentration (µg/L)	LCS % Recovery	Recovery Limits	Method	Notes
Inorganic Arsenic	0.030000	0.028	92.7	50 - 150	EPA 1632	

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## PREPARATION BLANKS

**Matrix:** Water

**Sequence:** 2C06014

**Instrument:** ICPMS-6

**Preparation:** Closed Vessel Nitric Oven Digestion

Lab Sample ID	Analyte	Found	MRL	Units	Batch	Method	Notes
F203070-BLK1	Arsenic	-0.01	0.1	µg/L	F203070	EPA 1638	U

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## Notes and Definitions

U	Analyte included in the analysis, but not detected
AS	This MS and/or MSD is an analytical spike and/or an analytical spike duplicate.
DET	Analyte Detected
MRL	Minimum Reporting Limit
ND	Analyte Not Detected at or above the reporting limit
wet	Sample results reported on a wet weight basis
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
RSD	Relative Standard Deviation

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A handwritten signature in black ink, appearing to read "C. Armstrong", is positioned above a horizontal line.

Curtis Armstrong, Project Manager

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